Space Weather Technical Forecast

Issued on Friday, 02 August 2024 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Occasional M-flares expected, chance of X-flares and of exceeding S1/Minor Radiation Storm threshold. Potential further CME blows Days 1-2 (02-03 Aug), chance of G1-G2/Minor-Moderate Geomagnetic Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Moderate, with occasional M-class flares observed from across the disc, the strongest M8.2 peaking at 31/0709 UTC, from AR3768, with a M4.1 flare also observed from AR3772 at 01/1135UTC. A highly active disc with fourteen sunspot regions. AR3768 in the far southwest continues be active providing the largest flare activity. It is becoming increasingly difficult to assess as it nears the limb. AR3765, AR3766 and AR3767 persist as a cluster of spots in the southwest disc, with AR3765 and AR3767 in particular in very close proximity, to the point where the two regions are pushed together with the trailing and leading portions sharing a penumbra. AR3770 to the north of the previously mentioned regions also persists as a region with two very marked delta spots, although the flare activity from this region has been generally more muted. AR3772 in the southeast has revealed a delta spot on one of its intermediate spots and remains highly active, giving the second largest flare of the period. The assessment of AR3774 near the east limb is still constrained by the viewing angle, so this classification may change.

Analysis and modeling of a broad CME associated with the M8.2 flare from AR3768 continues, with this feature perhaps having some Earth directed component. A fast CME was also observed associated with the M4.1 flare from AR3772 in the southeast, we await model output but given the region's location a significant Earth-directed component is unlikely.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, was mostly at slightly elevated levels between 400-450km/s, under continued weak CME influence. Density was highly variable, generally around or below average, peaking briefly above average at 16ppcc. The Interplanetary Magnetic Field, Bt, was generally moderate, falling weak at times, between 2-13nT. The north-south component, Bz, initially varied moderately, between +11/-11nT, but became weakly to moderately positive from around 01/0700UTC. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was generally Unsettled (Kp3), with a G1/Minor Storm (Kp5) interval observed at 01/0000-0300 UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at background levels throughout, with a slight temporary increase following the M8.2 flare. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels. The 24-hour fluence was below the Active threshold with 1.18e6 integrated pfu observed at 02/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Wind /Geomagnetic Activity: Current CME influence is ongoing, but with limited impact so far. Further CME arrivals are then possible on Days 1-2 (02-03 Aug). They are both low confidence, but glancing blows are possible on both days. Furthermore, due to the number of coincident CMEs, further arrivals cannot be ruled out through the period.

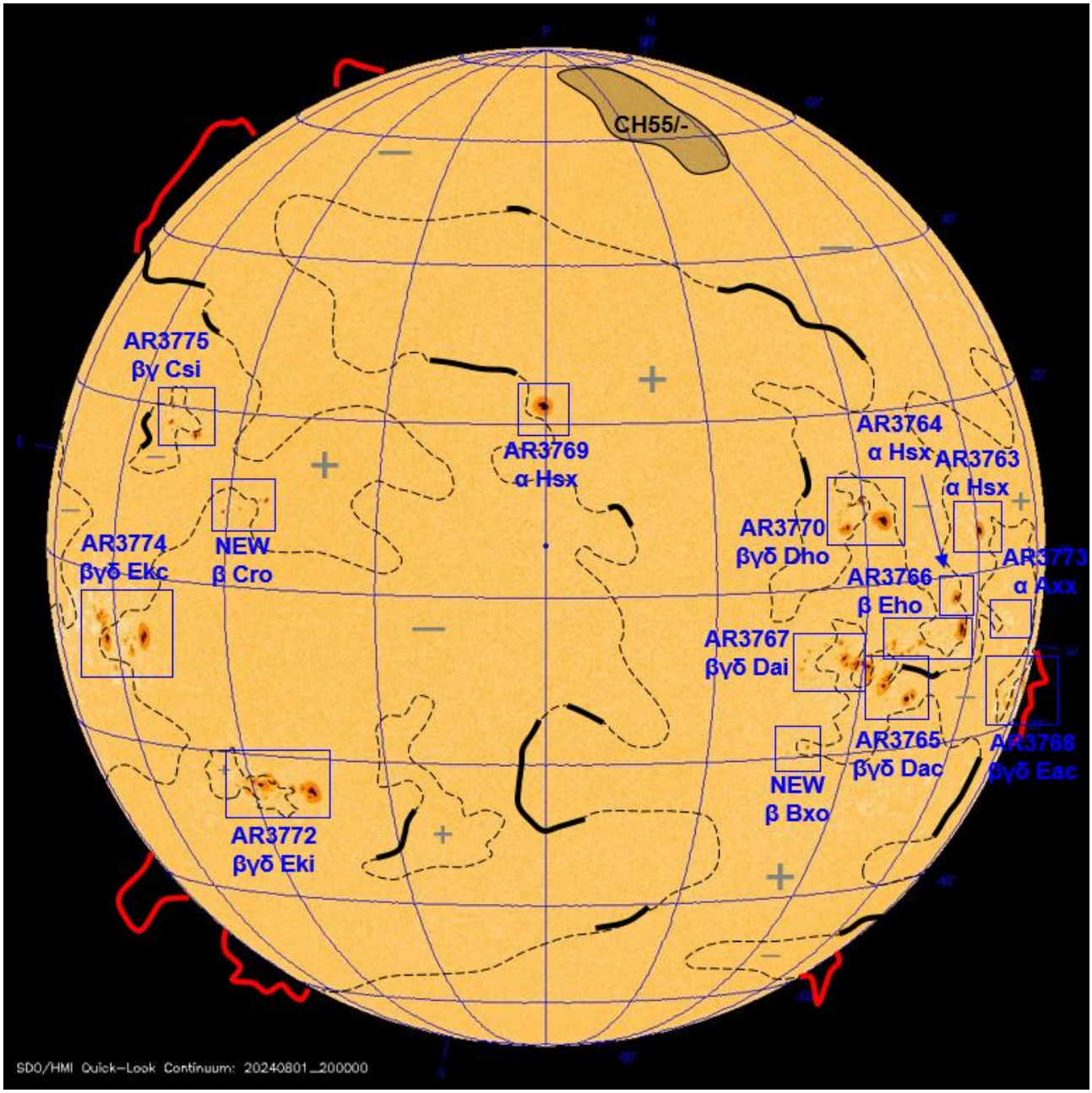
No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled, with periods of Active conditions likely and a persistent chance of G1-G2/Minor-Moderate Geomagnetic Storms should any CME arrivals bring more than a glancing blow. In the absence of further CME influence, activity is likely to become mostly Quiet later in the period.

Energetic Particles / Solar Radiation: High energy proton flux is currently at background levels. Should any notable flares occur in the western disk there is a chance of exceeding the S1/Minor Radiation Storm threshold. The high energy electron flux is forecast to be mostly at background levels, although moderate or perhaps high flux becoming possible at the diurnal peak on Days 2-4 (03-05 Aug). The associated 24-hour fluence is likely to remain below the Active threshold (1e8 integrated pfu), with a slight chance of exceeding by the end of the period.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1. Solar Analysis Valid 01/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

Earth is currently under weak CME influence from the arrival of CME arrivals during 31st July, keeping solar wind conditions slightly enhanced. These were likely from some combination of multiple CMEs that left the sun on the 28th July. Conditions expected to generally decline through Day 1 (02 Aug) in the absence of further enhancement.

Further CME arrivals are possible on Day 1 (02 Aug) however, with the chance of a glancing impact from the CME associated with a CME that left the Sun on the 30th July, although this is low confidence. A second glancing CME blow is possible later on Day 2 (03 Aug), associated with a broad CME from the recent M8.2 flare at 01/0709UTC from AR3768. Further analysis ongoing with this CME and a more direct blow remains a very slight possibility. Furthermore, due to the large number of coincident CMEs, including those off the Earth-Sun line, in recent day's analysis has been more difficult than usual. Consequently further arrivals cannot be ruled out through the period.

No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled, with periods of Active conditions likely and a persistent chance of G1-G2/Minor-Moderate Geomagnetic Storms should any CME arrivals bring more than a glancing blow. In the absence of further CME influence, activity is likely to become mostly Quiet later in the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	25	30	30	25
Strong	G3	No	1	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
30/0956	Partial	Filament/C5 flare	NW	607km/s	02/0000UTC +12hr	Low confidence glancing blow

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

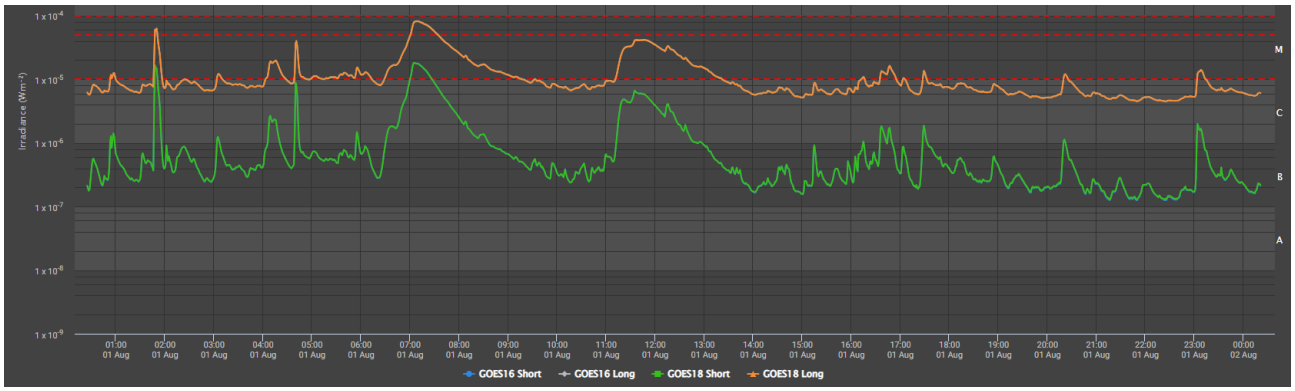
Radio Blackouts - X-Ray Flares:

A highly active disc with fourteen sunspot regions. AR3768 in the far southwest continues be active providing the largest flare activity with a M8.2, it is becoming increasingly difficult to assess as it nears the limb but will likely continue to contribute to the flare risk well into day 2 (03 Aug) as it rotates away. AR3765, AR3766 and AR3767 persist as a cluster of spots in the southwest disc, with AR3765 and AR3767 in particular in very close proximity, to the point where the two regions are pushed together with the trailing and leading portions sharing a penumbra. These regions flare risk only beginning to ease by the end of the period. AR3770 to the north of the previously mentioned regions also persists as a region with two very marked delta spots, although the flare activity from this region has been generally more muted. AR3772 in the southeast has revealed a delta spot on one of its intermediate spots and remains highly active, giving the second largest flare of the period. The assessment of AR3774 near the east limb is still constrained by the viewing angle, so this classification may change but the history of this region suggest the potential for significant flare activity.

Far-side sounding data suggests the potential for at least one significant oncoming region by the end of this guidance period. Provisionally a slight drop in flare risk is suggested through Days 3-4 (03-04 Aug) as the cluster of active regions in the west begin to leave the disk, although oncoming regions could potentially balance this decline. Overall Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares given the large number of complex active regions currently on the disk and activity over recent days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	90	90	80	70
Very Active	R3 to R5 X Class	No	30	30	25	20

Figure 2: Latest 24hr GOES16/18 X-Ray Trace.



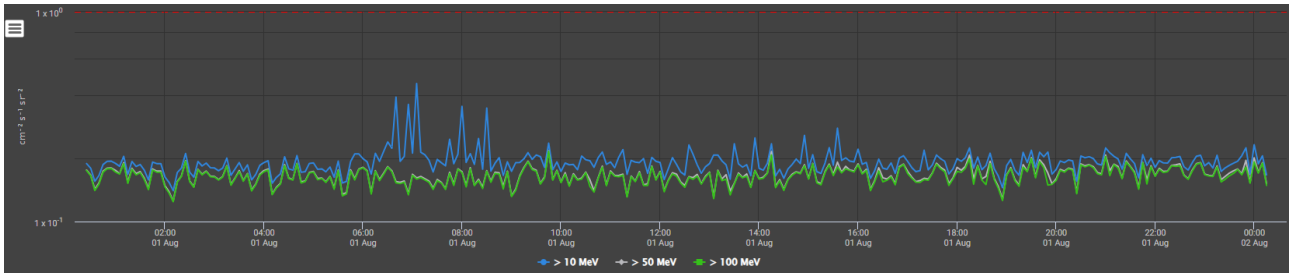
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as observed by GOES-18, is currently is currently at background levels but has the potential to rise in response to any notable flares on the disc, particularly those from the west of the disc and therefore in a favorable position to give proton enhancement given any significant flare activity. This brings a chance of reaching the S1/Minor Radiation Storm levels, reducing slightly by the end of the period as active regions in the west increasingly rotate away.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	30	30	25	20
Very Active	**≥ S3 ***	No	5	5	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: Latest 24hr GOES18 Proton Trace.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

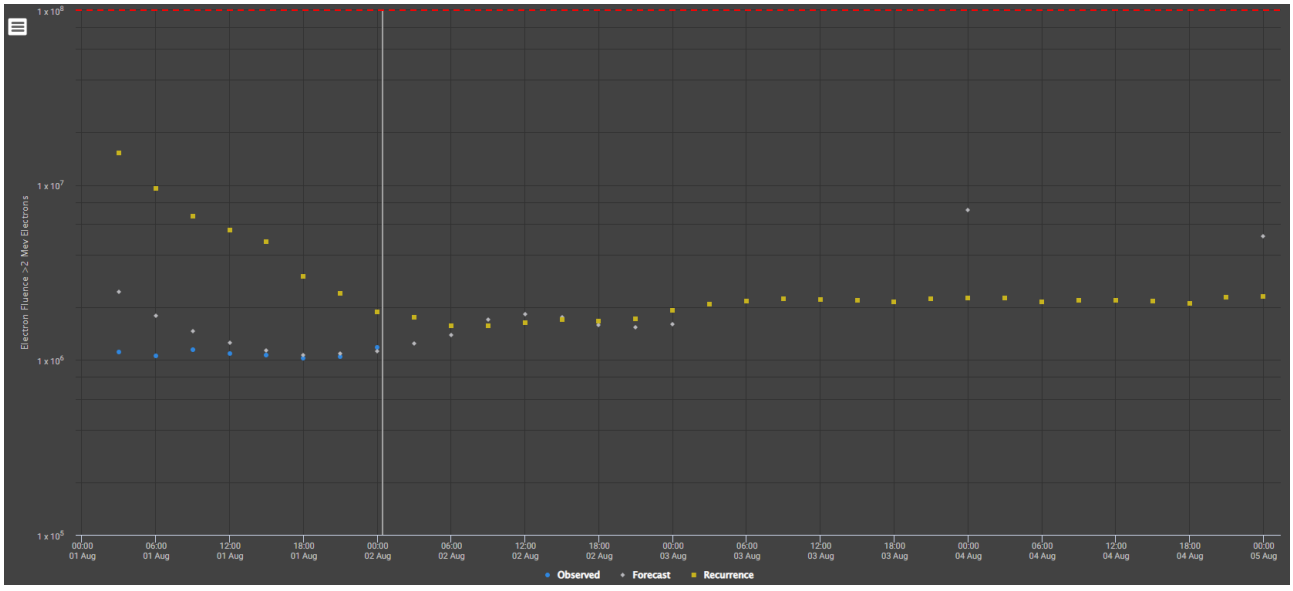
© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
High energy electron flux levels, as observed by GOES-16, is currently at background having been suppressed by recent CME arrivals. Further CME arrivals are likely to keep the observed flux near background levels in the short term, but recent CME activity is likely to have caused an increase in electron flux below GEO. Assuming CME influence wanes later in the period (an assumption where confidence is low), this will probably be reflected in an increase in electron flux later in the period, with moderate or perhaps high flux becoming possible at the diurnal peak on Days 2-4 (03-05 Aug).

The associated 24hr electron fluence is most likely to remain below Active (1e8 integrated pfu), although with the potential for a rising trend later in the period. There is a slight chance of exceeding Active by Day 4. MOSWOC REFM output suggests below Active through the period, which is reasonable, but confidence becomes increasingly low.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	15
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model output.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.